Amendments to the Specification

Please replace the paragraph beginning on page 1, line 22 with the following rewritten paragraph:

A1

--Such apparatus requires re-calibration from time to time due to changes in the apparatus' behavior, as might be affected by the state of processor chemicals if any are used, color marking system drifts, and changes in receiver characteristics. Differences in receiver characteristics might be caused by different recipes, variations in receivers from one coating event to another, and different surface finishes (i.e., glossy ~~verses~~ <u>versus</u> matte finishes) as are commonly encountered using photographic receivers.--

Please replace the paragraph beginning on page 4, line 1 with the following rewritten paragraph.

A2

--The present invention involves the rendering of a target containing not only neutral density patches but also a sampling of intentional off-neutral patches, produced by selecting sets of red, green, and blue ~~(and sometimes black)~~ input code values for those patches which deviate from sets of values that would produce neutral densities, and then, by analyzing how the measured densities of all the patches change with changes in code values, determining the optimum set or sets of the three ~~(or four)~~ input code values that when used together produce a desired set of aim neutral density patches in a single iteration.--

Please replace the paragraph beginning on page 5, line 10 with the following rewritten paragraph:

A3

--Referring to FIG. 2, a color image <u>10</u>, represented in digital form as a plurality of image input code values iCV_R, iCV_G, iCV_B, corresponding respectively to desired densities D_R, D_G, and D_B, is inputted by a digital image processor 12. The image processor or the reproduction apparatus contains three separate calibration lookup tables (or channels) in a 3-color reproduction

apparatus (one lookup table for each color: red, green and blue) for converting received digital input code values iCV_R, iCV_G, iCV_B into uniquely-associated drive code values dCV_R, dCV_G, and dCV_B, respectively, for a reproduction apparatus 14. The image processor or the reproduction apparatus may contain four lookup tables or channels for a 4-color reproduction apparatus (black and the other three colors). Mathematical transforms may be employed in lieu of lookup tables. Reproduction apparatus 14 uses the code values to produce color separations for the final rendering.--

A3

Please replace the paragraph beginning on page 5, line 23 with the following rewritten paragraph:

--Calibration of the color reproduction apparatus begins by specifying one or more aim curves of the desired density output as a function of input code values for the entire density range. In FIG 3, the diagonal line represents the desired behavior of the system for one possible aim curve description whereby input code values are linearly related to desired output densities. A calibration target containing a series of both neutral and non-neutral aim color density patches 16 is digitized into a series of density signals and passed through image processor 12 to remap the image's input code value signals into drive code values used by reproduction apparatus 14 to make a rendering. The resulting densities of the rendered patches are measured using an optical instrument such as a densitometer 18; and compared to the intended color densities. In FIG. 3, the data points are the actual measured densities from the target plotted against the target input code values. If, as in FIG. 3, any of the patch density values are different than intended, being either too light or dark, or possess a non-neutral hue, then, using a mathematical method such as regression, new sets of lookup table values or transforms are derived so as to increase or decrease the density of the corresponding color.--

A4

Please replace the paragraph beginning on page 7, line 10 with the following rewritten paragraph:

There are a number of mathematical paradigms for using this information. In a very simple example, a certain neutral aim color should be achieved with drive code values of, say, 100, 100, and 100. ~~If one renders three patches shown in FIG. 4, one with~~ <u>If one renders three patches, shown in Fig. 4: one with</u> drive code values 104, 99, and 99; the second with drive code values 99, 104, 99; and the third with drive code values 99, 99, and 104, and if in the domains 99 to 104 the behavior is assumed to be linear, relations between drive code values and resulting densities can be written as:

A5

$$D_r = a*dCV_r + b*dCV_g + c*dCV_b,$$

$$D_g = e*dCV_r + f*dCV_g + g*dCV_b, \text{ and}$$

$$\cancel{D_r}\ D_b = i*dCV_r + j*dCV_g + k*dC\cancel{V_b}\,\underline{V_b}.$$

Please replace the paragraph beginning on page 7, line 13 with the following rewritten paragraph:

--Since there are three sets of drive code values and three sets of resulting density points, (D_r, D_g, ~~D_r~~ <u>D_b</u>), there are nine equations and nine unknowns. This is a classical Matrix Algebra problem with known, published solutions. Once the nine coefficients are determined, the equations can then be used to solve for the unique set of ~~dCV_r, dCV_g,~~ <u>dCV_r , dCV_g ,</u> dCV_b of drive code values that produce the set of aim neutral densities, D_r, D_g, D_b. Given the information set forth above, numerous schemes using different numbers of variation patches and improved accuracy can be thought of by those skilled in the art. The minimum number of patches is three.

A6

Please replace the paragraph beginning on page 7, line 22 with the following rewritten paragraph:

--There would be two problems with the very simple example described above. One problem is that, depending on how the three sets of patches are chosen, one may never produce a neutral patch so one never can be sure that the neutral is in fact achieved. The second problem is that the functional behavior must be not only linear, but the function must pass through the origin. A simple

A7

solution to both problems in the above scheme is to add the neutral patch (100, 100, 100) as shown in FIG. 5, and to add an offset to the equations, such that:

$$D_r = C_r + a*dCV_r + b*dCV_g + c*dCV_b,$$
$$D_g = C_g + e*dCV_r + f*dCV_g + g*dCV_b, \text{ and}$$
$$D_b = C_b + i*dCV_r + j*dCV_g + k*dCv_b.$$

A1

Adding yet another point (total of 5 patches) would allow a quadratic term in the most sensitive channel. Equations might look like:

C -8

$$D_r = C_r + a*dCV_r + b*dCV_g + c*dCV_b + p_r*dCV_r^2,$$
$$D_g = C_g + e*dCV_r + f*dCV_g + g*dCV_b + p_g*dCV_g^2,$$
$$D_b = C_b + i*dCV_r + j*dCV_g + k*dCV_b + p_b*\cancel{CV_b^2}\ \underline{dCV_b^2}.$$

Adding additional patches would allow additional degrees of freedom to the equations and/or regression analysis to reduce the effect of noise.--

Please replace the paragraph beginning on page 8, line 9 with the following rewritten paragraph:

--The collection, called "cluster," of patches including the neutral patch and the deviated patches is hereafter referred to as a "ring-around." The target will have a group of clusters of patches, including the neutral patch and the deviated patches. Each cluster is used to produce one triad of red, green and blue drive code values that, when used together produce one neutral density patch. The ultimate objective is that each group of clustered patches is used to find a single triad of red, green and blue drive code values that produce a single aim neutral. Then, combining all such solutions for all the clusters of patches on the target, perform separate curvefits on the density vs. code value solutions for each of the color channels as if they were independent:

A8

$$D_r = f_{red}(dCV_r),$$
$$D_g = f_{green}(dCV_g),$$
$$D_b = f_{blue}(dCV_b),$$

with the understanding that these equations are valid only when used together and the collective solutions produce a triad of densities that correspond to an aim neutral. This set of functions can be called the neutral characteristic curves of the rendering device because they describe its native behavior when producing neutral colors.--